

**Reduction and Emergence in Physics and Cosmology:
A Workshop with George Ellis (University of Cape Town/CAS Visiting Fellow)**
CAS LMU, 16 May 2025

This workshop investigates the nature of emergence in contemporary physics and cosmology, with a special focus on its implications for reduction, explanation, and metaphysical interpretation. Recent developments in quantum gravity, cosmology, and the foundations of quantum mechanics challenge traditional reductionist frameworks and raise the possibility that key features of our world—such as spacetime structure, cosmological dynamics, or informational architectures—may be emergent rather than fundamental. Questions about the explanatory autonomy of higher-level theories, the legitimacy of metaphysics at non-fundamental levels, and the role of abstract and purposive causation in physical and technological systems form the core of the workshop's agenda. With George Ellis as special guest, we will explore how such issues bear on the status of effective laws, the structure of scientific theories, and the broader philosophical understanding of our universe.

Schedule

9.00-10.00 George Ellis
Reduction and Emergence in Physics and in Technological Applications

Coffee break

10.30-11.15 Christian List
Levels of Description and Levels of Reality: A General Framework

11.15-12.00 Stephan Hartmann
Analogies, Emergence, and the Structure of Effective Theories: Lessons from Quantum Field Theory

Lunch break

13.00-13.45 Daniele Oriti
Emergent (Relational) Cosmology from Quantum Gravity

13.45-14.30 Laurie Letertre
Laws without Spacetime: the Strategy from Global Constraints

Coffee break

15.00-15.45 Alyssa Ney
Is the Universe Fundamentally a Density Matrix?

15.45-16.30 Maria Hubert
How to Reduce the Quantum Formalism? The Quantum Reconstruction Program vs. The Ontological Model Framework

16.30-17.15 Sébastien Rivat
What is Effective Metaphysics?